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ABSTRACT

In the Fall of 1994, the Computer Science Department at Coastal Carolina University (Conway, South Carolina implemented a formal ethics component in the introductory computer science course required of all majors. Prior to the introduction of this ethics component into the curriculum, a survey of ethical attitudes was administered to all computer science majors. Two years later, a similar survey was given to computer science majors who have completed the ethics component. This paper contrasts the results of the two surveys as a method of analyzing the effectiveness of the department's strategy to promote ethical behavior. The results suggest the need to re-evaluate existing strategies. The paper concludes with a discussion of varying strategies for promoting ethical behavior and suggestions for further study. (Contains 11 references.) (Author)

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Evaluating the Effectiveness of a Formal Ethics Component in the Computer Science Curriculum

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Abstract

In the Fall of 1994, the Computer Science Department at Coastal Carolina University implemented a formal ethics component in the introductory computer science course required of all majors. Prior to the introduction of this ethics component into the curriculum, a survey of ethical attitudes was administered to all computer science majors. Two years later, a similar survey was given to computer science majors who have completed the ethics component. This paper contrasts the results of the two surveys as a method of analyzing the effectiveness of the department's strategy to promote ethical behavior. The results suggest the need to reevaluate existing strategies for promoting ethical behavior. The paper concludes with a discussion of varying strategies for promoting ethical behavior and suggestions for further study.

Introduction

Ethical practice and social responsibility have become important aspects of computer science education. The latest revision of the computer science curriculum, Computing Curricula 1991 [1], states that "undergraduate programs should provide an environment in which students are exposed to the ethical and societal issues associated with the computing field". According to Tucker, Barnes, and Aiken [10], in a summary report for Computing Curricula 1991, computer science students "need to be aware of the basic legal rights of software and hardware vendors and users, and they also need to appreciate the ethical values that are the basis for those rights. To provide the level of awareness, undergraduate programs should devote explicit curriculum time to the study of social and professional issues".

In the spring semester of 1994, the authors of this paper examined the ethical attitudes of 82 computer science majors enrolled at Coastal Carolina University in response to a survey that

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appeared in Effy Oz's [7] textbook, "Ethics for the Information Age," 1994. It was concluded that "Coastal Carolina University is not doing enough to promote ethical behavior."[2] As a result of that survey and to meet the requirements of the ACM/IEEE curriculum guidelines, it was decided, starting in the Fall semester of 1994, to implement a formal ethical component in CSCI 130, Introduction to Computer Science. This course provides a comprehensive overview of Computer Science as a discipline and is required as the first course for all students majoring or minoring in Computer Science. All professors teaching this course were asked to add an ethical component to their course syllabi, and portions of Oz's textbook [7] were adopted as a required supplemental text.

In an attempt to assess the effectiveness of the Computer Science Department's formal ethics component, another survey of ethical attitudes similar to the 1994 survey was conducted two years later, in the fall of 1996. The first survey was administered to students who did not have the ethics component as part of their curriculum, and the second survey was administered to students who did have the formal ethics component as part of their curriculum. In particular the study focused on the following questions:

1. What is the current attitude of the students regarding ethical issues?

2. Is there a difference in ethical attitudes between students who have had the formal ethical component and earlier students who did not?

3. How effective is the current strategy to promote ethical behavior?

4. What changes in the curriculum are suggested?

Methodology

The survey instrument was administered to 66 computer science students consisting of 2 freshmen, seven sophomores, 20 juniors and 22 seniors. Of this group, 51 had completed the formal ethics component found in CSCI 130 at Coastal Carolina University. Oz's original survey was designed to measure the moral imperative that illegal copying of software is inappropriate in all circumstances. Since Oz's survey was included in the material covered in the ethics component found in the CSCI 130 course, it was decided to modify the order of the original survey and include three additional ethics questions. Consequently, the 1996 survey included the following questions:

1. A law firm has offered you a generous contract to help upgrade their information system. When you suggest that they need to upgrade their software, you discover that they have illegally copied software. How would you respond to this situation? : (1) Demand that all illegal software be removed. (2) Suggest that all illegal software be removed. (3) Refuse to work for them. (4) Report them to the Software Publishers Association. (5) Ignore the illegal software.

2. Assume your friend owns a disk that contains a program you are highly interested in. The disk is not copy protected (i.e., it can easily be copied to another disk), but it is copyrighted (i.e., it is sold by software vendors). Would you copy the disk if the price of the software were: (1) over $250 (2) over $100 (3) over $50 (4) over $25 (5) over $5 (6) I would not copy the disk. [7]

3. You are contacted by a business to set up a computer system. The business buys software packages at your suggestion and you install them on their computer. Under what conditions do you feel it is appropriate to install the software on your own computer? : (1) Just while you are writing the programs for the business. (2) As long as you are maintaining the software for the business. (3) As long as you buy your own copies of the software. (4) I would not install it on my own computer.

4. Assume you have recently purchased a disk with software you need for your work. You paid $250 for it. A friend of yours approaches you and asks to copy the disk. Would you (1) Agree (2) Agree but ask him or her to share the cost of the software (3) Not Agree. [7]

5. Assume you have recently bought a disk with game software on it (such as flight simulator). You paid $25 for it. A friend of yours asks to copy the disk. Would you (1) Agree (2) Agree but ask him or her to share the cost of the software (3) Not Agree. [7]

6. Some software is referred to as shareware. It is neither copyrighted nor copy protected, but a new user is usually asked to send a contribution of $10-$50 to the author. Assume you have copied shareware that you consider unsophisticated, but useful. It seems that you use it occasionally. The author asked for a contribution, but did not specify any amount. Would you (1) Send nothing (2) $1-5 (3) $6-10 (4) $11-20 (5) Over $20. [7]

7. Assume you recently found a password de-encryption program on the Internet, would you: (1) Try it out on someone's account just to see how it works. (2) Use it to help a friend out who forgot his /her password. (3) Not use it at all.

8. Do you think software companies make (1) Huge profits (2) Large Profits (3) About average profit of other industries (4) Small profits. [7]

9. Software companies should have different prices (for the same software) for (1) corporate and governmental organizations, and (2) individual users: (1) Strongly Agree (2) Agree (3) Strongly Disagree (4) Disagree (5) Neither agree nor disagree. [7]

10. Society should deal with software as it does with books. Software should be available to users through software libraries, for a nominal fee: (1) Strongly Agree (2) Agree (3) Strongly Disagree (4) Disagree (5) Neither agree nor disagree. [7]

Results

In this study, questions 2, 4, and five were designed to measure the respondents' willingness to copy software illegally. Oz [7] used the cost of software as a distractor to get at the "real issue" of whether the students would copy software or not. The results contrasting the two groups are summarized in Table 1 below:

TABLE 1

Question 2: Would you copy software if it cost . . .

	1994 (No Ethics)	**1996 (Ethics)**
Would Copy	65%	67%
Would Not Copy	35%	33%

Question 4: Would you allow your $250 program to be copied?

	1994 (No Ethics)	**1996 (Ethics)**
Would Copy	66%	68%
Would Not Copy	34%	32%

Question 5: Would you allow your $25 program to be copied?

	1994 (No Ethics)	**1996 (Ethics)**
Would Copy	73%	72%
Would Not Copy	27%	28%

The null hypothesis tested was that there was no significant difference between the proportion of students who did not receive the formal ethics component and those who did receive the formal ethics component as part of the introductory computer science course, CSCI 130. In all three questions the null hypothesis was not rejected, i.e., the presence of the formal ethical component appears to make little or no difference in the respondents' answers to these questions.

Table 2 contrasts the results of the two groups willingness to pay the author of a useful shareware program for the software that is being used. In question 6, the null hypothesis is that there is no significant linear correlation between the responses provided by the two groups. In this case the null hypothesis is not rejected, i.e., there is not a statistical significant correlation between the two groups. This result is confirmed when is noted that those receiving the formal ethical component are more willing to pay higher rates for the shareware software, however, half this group would use the software and not pay the author at all.

TABLE 2

Question 6: What would you contribute for useful shareware?

	1994 (No Ethics)	1996 (Ethics)
Nothing	40%	50%
$1-5	18%	4%
$6-10	18%	28%
$11-20	17%	12%
over $20	7%	6%

Questions 8, 9, and 10 are used by Oz [7] to attempt to determine why the respondents would be willing to justify software piracy. The students in both groups were asked their opinions. As in the previous question, the null hypothesis for these questions is that there is no significant linear correlation between the two groups. The results are summarized in Table 3. The results for questions 9 and 10 show that the two groups' responses to these opinion questions were not linearly correlated. However, in both questions there were similarities. In question 9, 67% strongly agreed or agreed that software should be priced differently for organizations and individuals. In question 10, 78% and 64%, respectively, strongly agreed or agreed that software should be loaned like library books for a small fee. The null hypothesis was rejected in response to answers for question 8, i.e., both groups had similar responses as to the profits made by software companies.

TABLE 3

Question 8: What kind of profits do software companies make?

	1994 (No Ethics)	1996 (Ethics)
Huge	31%	33%
Large	39%	37%
Average	25%	29%
Small	5%	0%

Question 9: A software package should be priced differently for organizations and individuals . . .

	1994 (No Ethics)	1996 (Ethics)
Strongly Agree	36%	24%
Agree	31%	43%
Strongly Disagree	7%	2%
Disagree	17%	12%
Neither	9%	18%

TABLE 3 -Cont

Question 10: Software should be loaned like library books for a small fee . . .

	1994 (No Ethics)	1996 (Ethics)
Strongly Agree	36%	24%
Agree	42%	40%
Strongly Disagree	5%	2%
Disagree	9%	10%
Neither	8%	24%

Questions 1, 3, and 7 were included in the recent survey administered in the Fall of 1996 to the students receiving the formal ethical component. As noted in Table 4, in all three questions a majority of students who did receive the formal ethical component failed to respond with the ethical imperative.

TABLE 4

Question 1: You discover illegally copied software. How would you respond . . .

	1996 (Ethics)
Demand Illegal Software Be Removed	4%
Suggest Illegal Software Be Removed	71%
Refuse To Work	2%
Report To SPA	6%
Ignore Illegal Software	18%

Question 3: Under what conditions do you feel it is appropriate to install software on your own computer . . .

	1996 (Ethics)
While writing the Programs	10%
While Maintaining the Software	63%
Buy Your Own Copies of Software	18%
Would Not Install On My Computer	10%

Question 7: Use password de-encryption program found on Internet . . .

	1996 (Ethics)
Try It Out To See How It Works	30%
Use It To Find Forgotten Password	32%
Not Use It At All	38%

Conclusion

Obviously, the results strongly suggest that the formal ethics component introduced in the freshman year is having little impact on the students in the computer science program. It can be argued that the survey's primary emphasis was upon software piracy. Since computer ethics encompasses more than the issue of software piracy, the survey results are probably not an accurate measure of the students' ethical attitudes with respect to all ethical issues in computing. Johnson [4] suggests that courses on computer ethics "should have the following goals: (1) to make students . . . aware of ethical issues surrounding computers; (2) to heighten their sensitivity to ethical issues in the use of computers . . . ; (3) to give them more than a superficial understanding of the way in which computers . . . change society . . . ; (4) to provide conceptual tools and develop analytical skills . . . for ethical decision making." However, the results of the survey do show that at least in one measure of ethical behavior the methodology for teaching computer ethics is not working.

How should computer ethics be taught to computer science majors? One could require of all computer science majors a computer ethics course modeled after similar courses in business ethics which are required by many Business Schools. Accordingly, it could be debated as to whether such a course should be required at the freshman level, where, possibly, it could influence students' behavior throughout their academic career; or should a computer science ethics course be treated as a required capstone course affecting students who are about to enter the professional world. While often it is felt that beginning computer science students do not have the intellectual background or framework to adequately analyze ethical and social issues, Schulze & Grodzinsky [9] report that, from the very beginning, CS1 and CS2 students should be introduced to ethical and social issues as an integral part of the foundation courses. They take the position that "it is critical that students understand that irrespective of their viewpoint, ethical solutions must be consistent, coherent and defended with reason rather than emotion and intuition."[9]

Another area of concern is who should teach computer ethics? In many Business Schools, business ethics is taught out of the Philosophy Department. Johnson [4] in her article, "Who Should Teach Computer Ethics and Computers & Society?", advocates "it is best for philosophers trained in ethics . . . to teach . . . courses in computer ethics." She felt that in reality all ethical and professional issues dealing with computers have their antecedents in societal issues and ethics. Gotterbarn [3], in his response to Dr. Johnson's article, felt that computer scientists, as trained professionals, should teach computer ethics; "Who should teach computer ethics? I believe computer scientists are capable of learning the ethical theories and strategies . . . Given some training in ethical issues, provided by books, workshops, seminars, etc., they would be able to effectively include computer ethics in their classes." Responding to the question of how much training is necessary for computer scientists to effectively teach computer ethics, Werth [11] reports that computer ethics is an interdisciplinary study demanding "technical knowledge combined with a deep understanding of ethical and social principle and skills." Consequently, she argues that computer science faculty need to be trained to teach ethical and social issues.

In the September 1996 issue of Computers & Society, Riser & Gotterbarn [8] advocate that computer ethics should be taught across the computer science curriculum. They argued that " . . . the most effective ways to introduce ethics to computer science students is by the use of a variety of ethics activities in technical computer science courses taught by the regular computer science

faculty." The second report of Project ImpactCS [6] proposes that an expanded area of study in ethics be added to the curriculum. This area of study would be equivalent to a full course. The report also recommends that ethical and societal issues be integrated throughout the computer science curriculum. With this approach, ethical components are blended "seamlessly" in all classes throughout the major. Consequently there is a continuum of reinforcement, while stating for all concerned that ethics is something that computing professionals do on a regular basis.

Martin [5], in a National Science Foundation sponsored project, states that the two major problems "that hamper the implementation of an across-the-board curriculum" which integrates social and ethical topics in computer science courses is "the lack of materials that can be adopted or adapted into the existing CS curriculum and the lack of awareness and expertise on the part of most CS faculty." As a result of Martin's project, modules were developed to facilitate the teaching of ethics and faculty enhancement seminars were created to train computer science faculty to use these modules in topics throughout the computer science curriculum.

In conclusion, a one shot approach to computer ethics is not working at Coastal Carolina University. The formal ethics component implemented in the first computer science course required of all majors is important. However, the authors of this paper are in agreement with Riser & Gotterbarn [8] that ethics needs to be an integral component in all technical courses throughout the major. With this approach, computer science faculty are not faced with a dichotomy as to whether to sacrifice course concepts in lieu of teaching an artificial ethics component.

References

[1] ACM/IEEE-CS Joint Curriculum Task Force, "Computing Curricula 1991". ACM/IEEE-CS Joint Curriculum Task Force Report. ACM Press and IEEE Computer Society Press, NY 1991.

[2] Collins, E. & Sheel, S. "A Survey of Ethical Behavior in Students Enrolled in Computer Science and Information Systems Courses", S.E. TIMS, Myrtle Beach, SC, 1994.

[3] Gotterbarn, D. "Comments on the Feature Article: Who Should Teach Computer Ethics and Computers & Society?", Computers and Society, 1994, vol. 24, p. 13.

[4] Johnson, D. "Who Should Teach Computer Ethics and Computers & Society?", Computers and Society, 1994, vol. 24, p. 6.

[5] Martin, C. "Integrating Social Impact and Ethics into the Computer Science Curriculum", NSF Grant, Award # 9354620, 1994.

[6] Martin, C., Huff, C., Gotterbarn, D., and Miller, K. "Implementing a Tenth Strand in the CS Curriculum", Commun. ACM 39,12 (December 1996), 75-84.

[7] Oz, E. ETHICS for the INFORMATION AGE, Business and Educational Technologies, 1994, p.76.

[8] Riser, R. & Gotterbaum, D. "Ethics Activities in Computer Science Courses". Computers and Society. 1996. vol. 26. p. 13.

[9] Schulze, K. & Grodzinsky, F. "Teaching Ethical and Social Issues". SIGCSE Bulletin. 1997. vol. 29. p. 6.

[10] Tucker, A., Barnes, B. and Aiken, R. "A summary of the ACM/IEEE-CS joint curriculum task force report: Computing Curricula 1991". Commun. ACM 34,6 (June 1991). 68-84.

[11] Werth, L. "Getting Started With Computer Ethics". SIGCSE Bulletin. 1997. vol. 29. p. 1.